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ABSTRACT

Online museums could benefit from digital "lifelike" characters in order to guide users to virtual tours and to customize the tour information to users' interests. Digital characters have been explored in online museum web sites with different degrees of interaction and modes of communication. Such research, however, does not explore interactive "conversational" characters. The main interest of this research is a tour-guide character that provides tour information through dialogue with the user. This research developed an interactive conversational character that establishes a "character-user" dialogue while guiding the user through the virtual tour. The tour guide character provides tour information and responses to users' textual inputs by speaking through audio output and gesturing accordingly. Moreover, the tour guide character attempts to provide adaptive guidance, to perform engaging storytelling and to promote users' participation through the virtual tour. This paper describes the experiment focusing on the systems implementation, the dialogue creation process and the character's ability to detect users' interests. It further describes and analyzes the system's evaluation. Lessons learned could serve as a base for developers of interactive characters as tour guides. Includes two tables and three figures. (Contains 15 references.) (Author/AEF)

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# Interactive Character As A Virtual Tour Guide To An Online Museum Exhibition

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## Abstract

In real museums, visitors may seek the help of a human tour guide in order to guide them through the exhibition and present information tailored to their interests. Accordingly, online museums could also benefit from digital§ "life-like" characters in order to guide users to virtual tours and to customize the tour information to user's interests. Digital characters have been explored in online museum websites with different degrees of interaction and modes of communication (Bertoletti et al., 2001; Adams et al., 2001; Doyle, P. and Isbister, K. 1999). Such researches, however, do not explore interactive "conversational" characters. Our main interest is in a tour-guide character that provides tour information through dialogue with the user. Our research developed an interactive conversational character that establishes a "character-user" dialogue while guiding the user through the virtual tour. The tour-guide character provides tour information and responses to users' textual inputs by speaking through audio output and gesturing accordingly. Moreover, the tour-guide character attempts to provide adaptive guidance, to perform engaging storytelling and to promote user's participation through the virtual tour. In this paper, we describe the experiment focusing on the systems implementation, the dialogue creation process and the character's ability to detect user's interests. We further describe and analyze the system's evaluation. We hope lessons learned could serve as a base for developers of interactive characters as tour guides.

*Keywords: virtual guide; adaptive guidance; virtual tour; interactive virtual character; storytelling*

## *1. Introduction*

In real museums, visitors may seek the help of a human tour guide in order to guide them through the exhibition and present information tailored to their interests. Accordingly, online museums could also benefit from digital interactive "life-like" characters in order to guide users to virtual exhibitions and to customize the virtual tour information to users interests.

Digital characters have been explored in online museum websites with different degrees of interaction and modes of communication (Bertoletti et al., 2001; Adams et al., 2001) However, these researches have often limited their use to embodied alternatives to traditional menu or prompt-driven mechanisms for performing simple tasks such as searching for files or providing help information embedded in webpages. (Bertoletti et al, 2001; Adams et al 2001) Closer to our goals is Isbister's research where an agent guide tracks users words in a chat environment and provides more detailed or less detailed tour information accordingly. (Doyle, P. and Isbister, K. 1999) Our interest is, however, in an interactive conversational character that establishes a customized person-to-person dialogue while guiding the user through the virtual exhibition.

In recent years, due to technological advancements, interest on interactive conversational characters has sharply increased mainly in response to e-market strategies. E-service providers explore their potential as sale assistants that perform

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intelligent like behaviors such as greeting users, answering questions and suggesting personalized products. Some famous examples are: Linda (by Extempo), Julia (by Virtual Personalities), Nicole (by Native Mind), Lucy Mcbot (by Artificial Life). Such characters not only instruct, guide, advice and perform tasks on user's behalf, but also enhance the communication with users through both verbal and non-verbal interactions such as hand gestures, facial expressions and gaze movements.

Likewise, research on conversational characters in learning environments has concluded they not only facilitate the user experience with the learning environment but also highly improve the computer's ability to engage and motivate students. (Lester, J. et al 1997)

Traditional complaints about interaction with conversational characters highlight that their reactive, context-free conversation and their lack of goals and motivation for interaction inevitably lead users to interact for a short period of time as well as increase the potential for unmet expectations regarding the character's intelligence. Thus, researchers on character development have focused attention on the design of motivational structures, emotional and personality traits and behavior control systems for characters to perform in context-specific environments, with well-defined goals and social tasks. (Hayes-Roth 1998; Doyle, P. and Isbister, K. 1999; Lester, J. and Rickel, J. 1999) Emphasizing the importance of the social context for shaping user-character interactions, Doyle has suggested that in social tasks, in contrast to mechanical tasks, uncertain goals or goals of satisfaction rather than correctness, and dialogue rather than command-structured interactions, shape a good domain where an interactive conversational character may work well (Doyle, P.1999).

Within this framework, our research attempts to shape dialogue interactions between an interactive conversational character and the user in the specific context of a guided tour to a virtual exhibition. We hope to examine features of conversation tracking and interest monitoring in order to improve the dialogue process and to identify some features that could serve as a framework for developers of interactive characters as tour guides.

By observing the qualities of a human tour guide in a real museum, we developed a virtual tour guide to a virtual exhibition. A human tour-guide is expected to provide general information about the tour, to highlight curiosities about its objects, to tell stories related to the tour and to answer most frequent questions regarding tour and exhibition topics. Moreover, a tour guide's performance must include abilities to provide adaptive guidance and engaging storytelling, to stimulate visitors' participation and interest in the exhibition and to reincorporate information from previous tours.

Considering such qualities, we developed an experiment with an interactive character as a tour guide to a virtual exhibition. In the experiment, the user explores a virtual XVI Century Portuguese ship and objects inside while talking with and receiving information from the tour guide. In this paper, we describe the experiment focusing on the system implementation, the dialogue creation process and the character's ability to detect user's interests. We further describe and analyze the system's evaluation.

### *2. Guiding a Tour-Exhibition*

In real museum exhibitions, curators display objects, technical information, and narrative in space in order to convey the exhibition message. (Roberts, L. 1997) Tour guides often reinforce such narrative by conveying information that can be roughly divided in two levels: a presentation level, conveying general contextual information about the group of objects and their meaning, and an object-specific level, conveying information about the displayed object such as how it was made, by whom, why, when, how it was used, etc.

Presentation level information is normally introduced prior to the viewing of objects, at the beginning of the tour and/or at the entrance of each exhibition room, in order to contextualize them. Human-guides often present such information in a compulsory, non-interactive way in order to establish the atmosphere for conveying the exhibition

message.

For object-specific information, on the other hand, human-guides are more susceptible to visitors' interests. They are more likely to adopt a reactive approach in which the content of their speech will depend on how visitors interact with the exhibition material.

Moreover, besides these levels of information flow, a human tour guide must also have engaging storytelling abilities to stimulate visitor's participation and exploration of the exhibition environment. Telling about curiosities and calling visitor's attention to interesting details are some of the techniques used to shape an engaging guidance.

### *3. The Experiment*

Our experiment developed a virtual tour guide that leads a tour to a XVI century Portuguese ship. Users are invited to visit four rooms of the ship in a pre-defined sequence (Figure 1). Inside each room, room-related objects are exhibited. (Table 1) The rooms are HTML pages with images of objects (Figure 2).

| Rooms | Objects |
|---|---|
| 1. The Deck | a sailor, a cabinboy, a toilet basket |
| 2. The Pilot Room | a compass, an astrolabe, the Pilot |
| 3. The Storage Room | barrels of wine, biscuits, water and ammunition |
| 4. Captain's Room | the Captain, a route map, the Cross of Christ |

***Table 1: Rooms and exhibited objects***

The virtual tour guide provides information about each room and its objects. As the user enters the room, the virtual tour guide presents the room telling how it was used and what kind of objects the user can find there. Next, the user explores the objects in the room by looking at their images and reading their detailed textual information in a small window that pops-up when the mouse is over the object. After that, the tour guide makes some comments about what the user saw. Such comments will serve to start a dialogue that gives the tour guide tips on the amount of the user's interest on the room's objects and topics.

Topics for the guides comments and stories were generally divided according to the room and the objects exhibited inside. In this way, the "Deck" would lead to conversation and stories related to sailors' sanitary conditions, crew and food. The "Pilot room" would lead to conversation and stories related to sailing instruments, the helm, pilot responsibilities, etc. The "Storage room" covered information on food, armaments, diseases, animals on board, etc. And, finally, the "Captain's room" would cover information on the captain's responsibilities, the objectives of the discovery voyages, political and economical interests of the time, Portugal and India, etc.

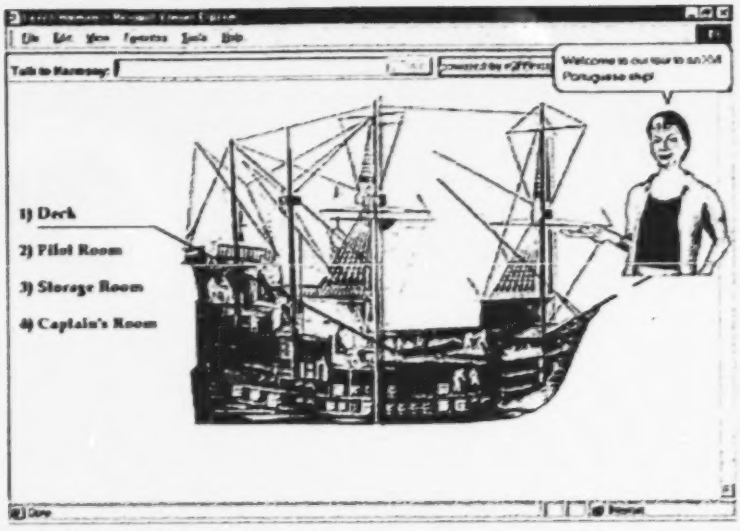


*Figure 1: Beginning the Tour*

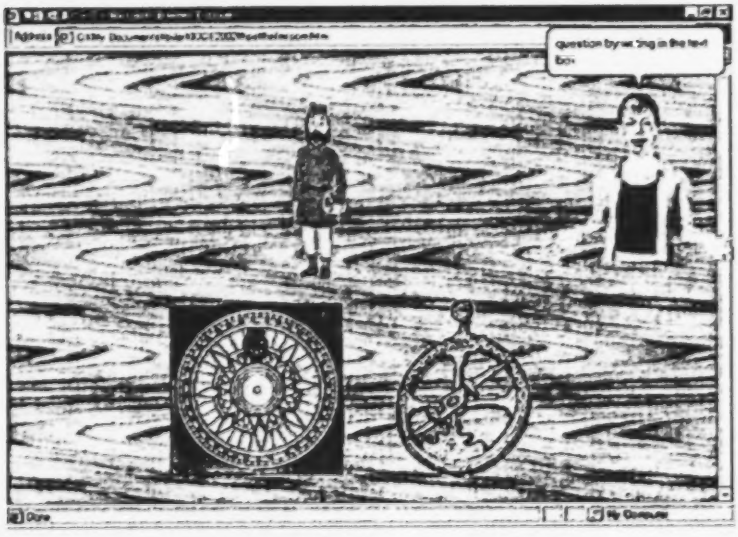

*Figure 2: Screen of the Pilot room*

### 3.1 System Description

The virtual tour guide system consists in two components: a computer keyword spot program with a natural language processing system that delivers pre-scripted statements from a knowledge-content database and an MS-Agent character that performs such statements as gesture-choreographed dialogue pieces.

The tour guide's remarks are delivered both, through textual balloons and audio output. User's inputs were textual entries in a textbox. (Figure 2)

The dialogue plan and the knowledge-database were designed and scripted with ImpCharacter Editor 2.1 develcped by Extempo Systems Inc. (http://www.extempo.com) (Figure 3).



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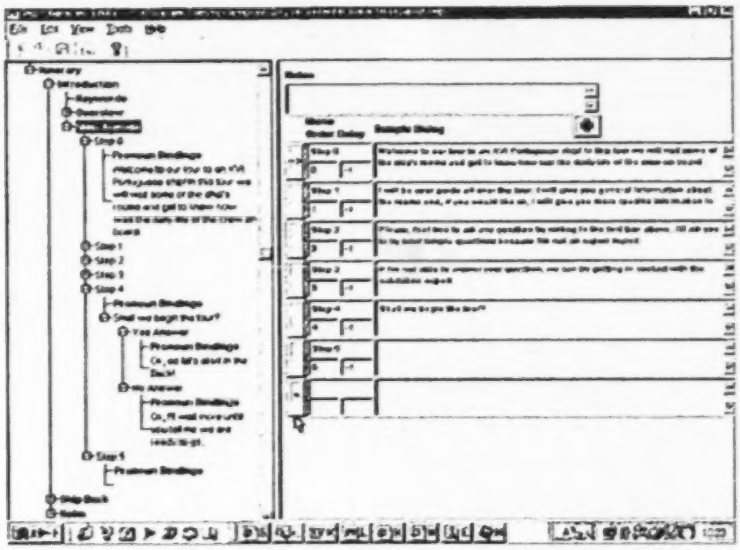

***Figure 3: Authoring the Guide's Dialogue and Knowledge***

### 3.2 The Tour Guide Knowledge-Database

§The tour guide knowledge-content database stores the dialogue steps, keywords (of three types: general keywords, room specific keywords and after-dialogue keywords), pre-conditions for the delivery of dialogue pieces, as well as the tour-guide personal history and mood settings.

By using pre-condition features, the tour guide can personalize the dialogue by tracking each dialogue piece and visited room in order not to repeat given information. In this way, even if the user asked to go back to a specific room, the tour guide would not offer the same dialogue pieces. Pre-conditions were also valuable for triggering extra-stories whenever the user was interested in more detailed information.

Also, the ability to arrange keyword schemes allowed the tour guide to make some "intelligent" inferences. For example, through the schema: [food] = [biscuits, bread, lunch, dinner, meat, fruits, eat], the following dialogue is possible:

Visitor: What would sailors eat for dinner?

**Guide**: We will get detailed information on the sailor's food as soon as we get to the storage room!!

### 3.3 Dialogue Creation and Detecting User's interest

Planning the dialogue flow for the tour-guide was the main work of our experiment. We wanted the guide to give information following the exact flow of a tour and exhibition visit. Moreover, we wanted the guide to detect user's interest in an indirect way. We feared that generic questions such as "Are you interested in this?" Or "Would you like more information about that?" would not sound natural and would not differ from a traditional multimedia menu-like environment.

The key moment to detect user's interest was during the dialogue triggered by the guide's comments after the user had explored the room. As we said, according to user's reactions to the tour guide comments, the tour guide would provide (or not) extra-stories about the room. The comments are, thus, supposed to be very

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instigating and provocative. Some examples of comments are:

> "Did you see the rope just beside the toilet basket? Do you know what it was used for?" (Deck)
>
> "Do you like olive oil and vinegar?" (Storage Room)
>
> "Can you guess any spice that could be found in Indian markets?" (Captain Room)

During the dialogue triggered by the tour guide comments, the tour guide checks for some supportive words (such as "nice", "cool", "interesting", "really?", "you bet!", "definitely", "sure",...) according to the dialogue piece. On finding such words, the tour guide assumes the user is interested and provides more information on the room.

The piece of dialogue below illustrates how indirect the detection of user's interests is.

> Guide:§ Did you see the rope just beside the toilet basket?
>
> Visitor: Yes
>
> Guide:§ Can you guess what it was used for?
>
> Visitor: It seems a brush
>
> Guide: Yeah. This rope with a fayed end was used as toilet paper. It was kept under water and pulled up when someone needed it!
>
> Visitor: Yuck!!! I would never use it!!
>
> Guide:§ Yeah, people were not very clean those days

In this example, the supportive word was "yuck"(along with several possible others such as disgusting, terrible, dirty, God, etc). The guide assumed the user had a good reaction to this story and will provide further stories.

Another way to detect user's interest was from user's questions. Keywords for possible questions and their answers were pre-defined.§ Each question was related to a specific room. Whenever the user asks a question, the guide provides the answer and tells extra stories when the user reaches the room related to the question.

### *4. Evaluation & Analysis*

We conducted preliminary tests to our experiment with eleven university students. We used both the tour's dialogue transcripts and user evaluation questionnaire data to determine how effective the tour guide was as a way to convey adaptive guidance and storytelling to virtual exhibitions.

In the evaluation questionnaire, students were asked to grade the experience with the tour guide using a scale from "very good" = 4 to "not good" = 1.

**Questionnaire Evaluation Results**

| |
|---|
| **1 Entertaining Experience (3.38)** |
| **2 Learning Experience** |
| 2.1 Motivation (3.3)<br>2.2 Better Understanding (3.15) |
| **3 Dialogue Interactions & Adaptive Guidance** |
| 3.1 Encouragement to speak (3.05)<br>3.2 Adequate responses (2.35)<br>3.3 Interests detection (2.15) |

***Table 2: Evaluation Results***

As shown in Table 2, in regards to an entertaining experience, the average value suggests that visitors found the experience of dialoguing with a virtual tour guide character really enjoyable. (Avg=3.38) Data shows also that the tour guide was effective in motivating users to explore and learn more about exhibition topics. (Avg=3.3) Yet, visitors were slightly less sure about the extent to which the character's remarks helped them better understand the exhibition topics. (Avg=3.15)

In regards to the quality of dialogue interactions and the tour guide ability for adaptive guidance, users felt the character satisfactorily encouraged them to speak and interact with exhibition material. (Avg=3.05) Yet, regarding the character's ability to respond to users' questions, the average achieved a regular level. (2.35) This data suggests that more work should be done to improve the character knowledge, that is, more keywords to its database. Users also hardly recognized the ability of the character in providing further information when they were interested. (2.15) This data shows that our decisions for capturing users' interests (based on "supportive words" and questions) were not perceived as the character natural ability to provide further information. This could be highly alleviated by language tips such as "Since you asked about....", "Since you seem interested in...". In our experiment, such introductory remarks were nonexistent. The tour guide simply provided extra stories when she detected user's interest. Also, users easily confused this programmed choice with the tour guide's inability to respond certain questions.

The last question of the questionnaire was an open question regarding the presence of the character. The question was: "If you could choose the same virtual exhibition with or without the tour guide, which one would you choose?". All users with no exception chose *with* the tour guide. In general, users reaction to the experiment showed the experience of talking to the tour guide was highly different from individual multimedia exploration and it played an important role in motivating them to explore the exhibition material.

### *5. Lessons Learned & Future Work*

As a result of the evaluation process, some preliminary (and relatively simple!) corrections were evident and would highly increase the tour guide performance. We hope they may serve for future developers of tour guide characters.

**More knowledge in her knowledge–database, especially exhibition-related vocabulary.** The experiment shows that the universe of questions is highly limited to the exhibition information. Though a hard work, it is less hard than one might think!

**Better use of personal introductions.** Her personal introduction and personal questions to users could be used to "break the ice" and to determine user's interests.

**Tension alleviation when she does not understand questions.** She must provide a way out of the tense cycle created whenever she does not understand questions. Rather than only ask to rephrase or say she is sorry, she must offer a different conversational topic.

**User's prompt understanding of an "exhibition-like" information flow.** Users should be told they are about to experience the context of an exhibition visit and that they will receive information and are expected to behave accordingly.

**Clear names or numbers for exhibition objects**. Users may want to ask about objects and they need clear ways to identify them.

We are now making the corrections listed above and we plan to conduct further tests that may compare students' interactions with the virtual exhibition in environments with and without the virtual tour guide.

### *Conclusions*

In this research we developed an interactive character as a virtual guide to an online museum exhibition. Features such as adaptive guidance, engaging storytelling, stimulation of user's participation were attempted while building the character's knowledge and dialogue creation process. Though evaluation results show some limitations of the tour guide as a successful dialogue-builder, we believe this was highly due to the experiment's preliminary stages and could be substantially alleviated with the corrections listed in section 5. Moreover, despite such limitations, the experiment successfully proved the potential of conversational interfaces to motivate users to interact with the multimedia material. We hope lessons learned may serve as a foundation for developers of interactive characters as virtual tour guides.

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